

Redwood Creek Symposium Proceedings, Watershed Condition & Needs Report Orick, California, December 10, 2014



Photo Credit: NPS-Redwood National Park

Compiled by
Laura Bridy, Pacific Coast Fish, Wildlife and Wetlands Restoration Association

Notice

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Introduction

The Redwood Creek Symposium convened in Orick, California on December 10, 2014. Researchers and agency personnel presented current information, including: physical and biological aquatic studies, evolving threats to current ecological systems, and the dynamic climate within the Redwood Creek watershed. Attendees included community members, researchers, agency personnel, NGO staff and other interested parties. Following the presentations, a discussion took place to identify research, management, action, and data needs in relation to drought and climate variability for the watershed. The symposium, funded by the California Department of Conservation and organized by Pacific Coast Fish, Wildlife and Wetlands Restoration Association, was an opportunity to network, collaborate, and share ideas about the past, current and likely future conditions of the Redwood Creek watershed from a variety of perspectives. This document was compiled by Pacific Coast Fish, Wildlife and Wetlands Restoration Association and contains abstracts from each presenter, a summary of the needs discussion, and a list of attendees.

Acknowledgements

Pacific Coast Fish, Wildlife and Wetlands Restoration Association would like to thank staff from the following organizations for their advice and support in organizing and conducting the symposium: the Bureau of Land Management; Redwood National Park, Green Diamond Resource Company, and National Marine Fisheries Service. Appreciation goes to Los Bagels, Wildberries Marketplace, and the North Coast Co-op for their donations of delicious refreshments. We would also like to thank all the presenters and attendees for their interest and keen participation.

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Long-term trends in channel response and stream temperature in Redwood Creek, California

By Vicki Ozaki, Geologist, Redwood National Park

Redwood Creek has experienced dramatic changes in channel configuration, sediment loads and stream temperatures over the last 50 years. Large floods (1950's to mid-1970's) combined with widespread timber harvesting and road building, and unstable geology caused extensive erosion and sedimentation. As a result, Redwood Creek is currently listed as sediment and temperature impaired under the Clean Water Act (Section 303d) and three out of four salmonid species are federally listed as threatened under the Endangered Species Act.

Channel Monitoring: For the past four decades, the U.S. Geological Survey (USGS) and Redwood National Park have monitored channel changes through surveys of channel width, bed elevation, pool depths and frequencies, and analyses of the gravel particle size on the river bed.

The history of the flood sediments differed between upstream and downstream reaches of Redwood Creek. Channel filling was especially severe in the headwaters, but by the mid-1980's the channel had cut down to pre-flood levels, the gravel size in the streambed had doubled, and remnants of flood deposits along valley walls were becoming well vegetated and stabilized. In contrast, in lower Redwood Creek, channel filling continued through the 1980's as sediment was flushed from upstream to downstream. By the early 1990's the entire channel was downcutting and the size of streambed gravel was slowly increasing. As the channel has incised, the number of pool and depths have increased, but a 10-year flood in 1997 resulted in sedimentation in the stream which reversed the recovery trend for several years. The entire Redwood Creek channel has either reached a stable bed elevation (upper basin) or is downcutting (lower basin). Sediment from large floods has persisted in Redwood Creek for over a half-century.

Water Temperature Monitoring: Redwood National Park in collaboration with the USGS has monitored summer stream temperature along the mainstem of Redwood Creek and tributaries since 1997. In addition, a thermal imaging flight of the lower 59 miles (95 km) of Redwood Creek captured water temperature on the peak stream temperature in the summer of 2003. Over 16 years of temperature data characterize the thermal conditions in Redwood Creek.

Unlike many rivers where stream temperatures get warmer in a downstream direction, on Redwood Creek the highest water temperatures occur in the middle basin and cools downstream to the mouth. Coastal fog, a high number of measured cool springs, seeps, and cold pools in the lower reaches contribute to the cooling there.

Studies by Welsh et al. of the presence/absence of juvenile coho based on stream temperature indicate the mainstem of Redwood Creek exceeds the Maximum Weekly Maximum Temperature (MWMT) where juvenile coho are expected to be present. Currently the existing summer water temperatures are unfavorable for rearing juvenile coho salmon. On Redwood Creek the Redwood Valley area (mid-basin) has recorded the highest daily water temperatures, MWMT and MWAT for the entire length of the stream and for the period of monitoring.

Stream temperatures measured at a USGS gaging station in the upper basin are becoming cooler. In the late-1970's, the average daily water temperature during July and August ranged from 22-29 °C, but more recently they ranged from 18-22 °C. While Redwood Creek is on a recovery trajectory towards cooler stream temperatures, three juvenile fish kills were documented by Calif. Dept. of Fish and Wildlife in 2006, 2009 and 2014. Recovery of the species will require a return to cooler summer stream temperatures.

Fifty years later - The legacy of the 1964 flood in the Redwood Creek watershed

By Mary Ann Madej, Research Geologist Emerita, U.S. Geological Survey, Redwood Field Station

Fifty years ago, in December 1964, a large storm struck much of California, Oregon, and Washington. The resulting flood transformed much of the North Coast landscape and left a long-term signature on natural resources as well as on forest policies. 1964 storm rainfall totals (almost 500 mm) for the upper Redwood Creek basin were the highest since the late 1800's. The Orick valley was inundated by the flood, and sand deposits of >30 cm were deposited on much of the northern floodplain of Redwood Creek, with more silt-rich deposits on the southern floodplain. Widespread bank erosion along the downstream-most meander of Redwood Creek (now called the South Slough) was evident. In response to extensive flood damage, the Army Corps of Engineers built flood control levees along lower Redwood Creek between 1966 and 1968. Estuarine habitat was greatly reduced, water circulation patterns were altered, and to this day fish populations are affected by the changed water quality and water volume conditions associated with the levees.

The storm triggered 877 landslides along the mainstem of Redwood Creek, and an additional 975 landslides in tributary basins, stripping $5.2 \times 10^6 \text{ m}^3$ of soil and regolith from the hillslopes. High landslide activity was concentrated in steep, inner gorge reaches underlain by sandstone bedrock. Scars of the landslides still persist where soil was denuded and forest productivity decreased.

Widespread deposition of gravel, sand, and silt, along with large woody debris, dramatically changed the river channel, gravel bars and alluvial flats of Redwood Creek. Where terraces and higher alluvial flats were inundated with slow moving water, silt was deposited. Silt can be easily incorporated into the soil column and redwood trees send out adventitious roots into the fresh deposits. Silt lines on tree trunks are still evident in many areas, including the Tall Trees Grove. In contrast, long-term impacts from coarser gravel and sand deposits on lower elevation alluvial flats and gravel bars are apparent by the legacy of dead and dying redwoods along stretches of Redwood Creek.

The damage from the 1964 flood raised awareness of the effect of land use on watershed response. Much of the hillslope and river channel damage was linked to poor logging and road construction practices in the preceding two decades. A few years later, the California Forest Practice Act was enacted in 1973 as a nascent effort to control erosion and resource damage from logging activities on private lands.

The meteorology of the 1964 storm was not especially unusual, and most climate change scenarios predict increased intensity of storms in the future. Consequently, lessons learned from past floods should be incorporated into future planning efforts.

Status of summer steelhead in mainstem Redwood Creek

By David G. Anderson, Fisheries Biologist, Redwood National Park

Summer steelhead (*Oncorhynchus mykiss*), a federally listed salmonid, have been monitored by the NPS for 34 years on Redwood Creek in Redwood National Park and private lands upstream. The adult fish migrate upriver in spring, hold in pools during summer, and spawn during winter. Park staff snorkel 24 miles of mainstem Redwood Creek in summer to index population trends. Additionally mainstem and tributary water temperatures are measured, coastal cutthroat trout counted, and other aquatic species noted. Redwood Creek summer steelhead are a declining stock. The combined effects of land use and significant storms have deposited large amounts of sediment in mainstem Redwood Creek, increased water temperatures, and degraded fish habitat. Given high summer water temperatures and absence of deep pools, the prospect for recovery of Redwood Creek summer steelhead is poor.

Drought, stream flow, adult Chinook salmon upstream migration, and smolt production within the Redwood Creek basin

By Michael Sparkman, Fisheries Biologist, California Department of Fish and Wildlife

A primary objective of long term studies on anadromous salmonid populations is to encompass as much biological and environmental variability as possible. Several studies in Redwood Creek (RC) have assessed abundances of juvenile and adult anadromous salmonids at various locations within the basin. California Department of Fish and Wildlife has monitored smolt populations at three locations within the RC basin for the past 4 – 15 years, and more recently operated sonar cameras (DIDSON) to enumerate adult escapement to lower and mid-upper RC. This presentation will focus on the response of Chinook salmon in RC to drought conditions in WYs 2013 and 2014. Adult Chinook salmon enter RC from September – January, with first entry dependent upon when the mouth opens to the ocean. The mouth opened to adult passage in October 2013, and in September in WY 2014. Drought in California began in WY 2012 and extended to at least WY 2014. USGS operates stream flow gages in the upper and lower basin, with record lengths 43 to 63 years. Average daily discharge in lower RC in WY 2013 was 39% below average, and in upper RC 40% below average. In WY 2014 average daily discharge was 59% below average in lower RC, and 67% below average in upper RC. Average daily stream flow in WY 2013 from October – January was 15% below average in lower RC, and 9% below average in upper RC. In WY 2014, average daily stream flow during September – January was only 83 cfs in lower RC and 15 cfs in upper RC. Stream flow at both locations during the migratory period was 93% less than historic averages. Adult Chinook salmon escapement to lower RC in 2012/13 equaled 3,200 with a resulting basin-wide smolt output of 663,676 or 207 smolts/adult. Although the sonar camera was not operated in 2012/13, foot surveys in mid to upper RC on a single day counted 500 individuals within two stream miles. Smolt output from mid-upper RC in 2013 was the highest of record, and equaled 680,747. In 2013/14, 3,500 adult Chinook salmon entered lower RC, but only 84 adults migrated upstream into mid-upper RC. Smolt output from mid-upper RC (3,470 or 41 smolts per adult) was 99% less than output in 2013. The low smolts/adult value in the upper basin was likely due to: later than usual arrival timing and spawning, restricted spawning areas, and a low number of adults per stream mile (2.3 adults/mi). Smolt output through lower RC equaled 224,184 or 64 smolts/adult. The basin-wide reduction in smolt abundances through lower RC in WY 2014 compared to WY 2013 equaled 439,432 and smolts/adult decreased by 69% from WY 2013. These observations show that in the

drought of WY 2013 when adults were able to access the upper basin, smolt production was the highest of record. Although 300 more adult Chinook salmon migrated into lower RC during the severe drought in WY 2014, few were able to enter the upper basin, and basin wide smolt production was greatly reduced. We suspect that attributes of river substrate geomorphology important to successful salmonid spawning and hatching are more abundant in the upper reaches of RC. These prime spawning areas are additionally more productive to salmonids of RC in water years that allow access during optimal spawning times. Access to these prime spawning sites may largely control salmonid abundance for the entirety of the RC drainage. This study highlights the need for long term studies on adult and smolt populations at various spatial scales to adequately address biological and environmental variability. In addition, such studies can provide empirical data useful for answering specific questions regarding interactions between drought, migration, survival and population abundances.

Prairie Creek sub-basin life cycle monitoring, 1998-2013

By Walter G. Duffy, PhD., Adjunct Professor, Humboldt State University; Emeritus Leader, California Cooperative Fish and Wildlife Research Unit, U.S. Geological Survey

We monitored coho salmon (*Oncorhynchus kisutch*) in Prairie Creek and selected tributaries from 1998 through 2013 and also measured aspects of other salmonids, Chinook salmon, (*O. tshawytscha*), steelhead (*O. mykiss*), and coastal cutthroat trout (*O. clarkii clarkii*). In addition, 12 graduate students produced theses focused on different aspects of salmonid ecology in the stream.

Number of coho salmon fry emerging from capped natural redds in Prairie Creek averaged 908 fry/redd, in Streelow Creek 956 fry/redd and in Boyes Creek only 130 fry/redd. Survival of known age coho salmon eggs introduced to artificial redds averaged 70% at egg hatching and declined to 32% at fry emergence.

Abundance of juvenile coho salmon in Prairie Creek averaged 5,454 fish annually, while in Boyes Creek it averaged 2,352 and in Streelow Creek 2,656 fish. Abundance did not differ statistically among most years. Density of juvenile coho salmon during summer in Boyes Creek (0.77 m^{-2}) was statistically greater than in either Prairie Creek (0.33 m^{-2}) or Streelow Creek (0.38 m^{-2}). Survival of juvenile coho salmon between July and October was greatest in Prairie Creek (mean = 92%), intermediate in Streelow Creek (mean = 75%), and lowest in Boyes Creek (mean = 68%). Fork length of juvenile coho salmon during July and August averaged 59.6 mm, while weight averaged 2.35 g. Size of juvenile coho salmon in the Prairie Creek watershed was negatively related to their density in pool and run habitats. Specific growth rates of juvenile coho salmon in the Prairie Creek watershed were greatest between May, at hatching, and July. Absolute growth in both length and weight was greatest during October - March and lowest during July - October. Average annual production of age 1+ coho salmon from the lower Prairie Creek was 9,078, in Streelow Creek it was 2,942 and from Boyes Creek was only 467.

Escapement of adult coho salmon to Prairie Creek, estimated using live fish area-under-the-curve (AUC) methods, averaged 297 fish, using redd expansion methods it was 312 fish. Coho salmon escapement using redd expansion methods was positively related to escapement estimated using AUC methods. Coho salmon escapements estimates for Prairie Creek relied on sampling about 16 km of habitat most years, providing an average spawner/km estimate of 18.5 to 19.5 fish. Run timing of adult coho and Chinook salmon during five years of weir operation overlapped with average date of Chinook salmon arrival at the weir preceding coho by about one week.

Estimated rates of survival for coho salmon during freshwater residency are within the ranges reported by others. Calculated survival during freshwater residency averaged 30.8% and ranged from 16.3% to 82.3%.

Status of western pearlshell freshwater mussels in lower Redwood Creek - An indicator of watershed health and recovery

By Keith Bensen, Fish and Wildlife Biologist, Redwood National Park

Western pearlshell freshwater mussels (*Margaritifera falcata*) were re-discovered in Redwood Creek in 2007. No Unionid freshwater mussels had been reported in Redwood Creek since the 1950's. An inventory of lower Redwood Creek was conducted from stream kilometer 27 (Bridge Creek junction) to 6.75 (Redwood National Park boundary near Orick) from 2008-2010. Only 56 individual mussels were recorded. The mussels were scattered across 13 "beds" (aggregations of mussels) from stream kilometer 26.50 to stream kilometer 11.30. Twelve of the 13 beds contained from one to four individual mussels. One bed contained 23 individuals. Mussel sizes were: mean = 63 mm, S.D. = 22 mm, range 20 – 90 mm. Incidental mussel sightings were recorded during summer steelhead monitoring surveys from stream kilometer 46.50 (Lack's Creek junction) to 26.50 (Bridge Creek junction) between 2009 and 2014. Less than ten mussels have been incidentally seen outside of the inventory area.

Western pearlshell freshwater mussels are superior bio-indicators of watershed health. They are very long lived (over 100 years), sessile, require cold, clear, slightly acidic water, and sufficient rocky habitat. They are also tightly linked with salmonids, which they use commensally during their free-floating larval (glochidia) phase to move back upstream. The western pearlshell population in Redwood Creek is extremely small as compared to the robust population found in Mill Creek (Smith River) that contains more than 10,000 individuals. The mussels' presence in Redwood Creek means they were able to survive major sedimentation events, such as the 1964 flood, and significant changes to the channel. They have also assumedly been negatively affected by the decrease in salmonids within the watershed. The fact that very small mussels (< 30 mm) were recorded, however, is encouraging because it means that habitat conditions have recovered sufficiently to allow mussels to continue to successfully reproduce. The population is effectively a remnant one that is very slowly recovering.

Does water chemistry limit the distribution of New Zealand mud snails in Redwood National Park?

By Darren Ward, Assistant Professor of Fisheries Biology, Humboldt State University

New Zealand mud snails (NZMS) are exotic mollusks that are established and very abundant in many waterways of the western United States. In 2009, NZMSs were detected Redwood Creek in Redwood National Park in Northern California. Although NZMS are noted for their ability to increase rapidly in abundance and colonize new habitats, after more than 4 years in the Redwood Creek their distribution remains limited to a ca. 300 m reach of the estuary. Recent literature suggests that low specific conductivity and environmental calcium can limit NZMS distribution within watersheds. We conducted laboratory experiments, exposing NZMS collected from Redwood Creek to both natural waters and artificial culture media, to determine if low conductivity and calcium concentration limit the distribution of NZMS in Redwood National Park. For natural water

exposures, we held NZMS in water from their source location in the estuary (conductivity 135 $\mu\text{S}/\text{cm}$, calcium 20 mg/L) or water from one of four other locations in the Redwood Creek watershed that encompass a range of conductivity (77 -158 $\mu\text{S}/\text{cm}$) and calcium concentration (8-28 mg/L). For artificial media exposures, we manipulated both conductivity (range 20-200 $\mu\text{S}/\text{cm}$) and calcium concentration (range 5-17.5 mg/L) in a factorial design. Response variables measured included mortality and reproductive output. Adult NZMS survived for long periods (> 4 months) in the lowest conductivity waters from Redwood Creek and all but the lowest conductivity artificial media, regardless of calcium concentration. However, reproductive output was very low in low-calcium natural water and artificial media. Our results suggest that water chemistry may limit the spread of NZMS in Redwood National Park by reducing their reproductive output.

Sudden oak death in the Redwood Creek watershed and potential drought impacts

By Dan Stark, Brendan Twieg, and Yana Valachovic, University of California Cooperative Extension, Humboldt and Del Norte Counties

In August and September of 2014, the first known infestations of *Phytophthora ramorum* were discovered within Redwood National Park (RNP)—initially near the mouth of Bridge Creek at Redwood Creek and later between Bond and 44 Creek. A 35-acre area with *P. ramorum* symptoms, plus a 100-meter buffer, has been treated by RNP at the Bridge Creek infestation. All tanoak and California bay laurel were felled, lopped, and scattered within these combined ~100 acres. Treatments at the Bond to 44 Creek infestations are pending dry conditions and are expected to cover about 55 acres.

The origin of these infestations is unknown; however, the nearest known infestation is approximately 11 air miles south, near the confluence of Redwood and Lacks Creeks. Due to the popularity of the Bridge Creek site, it is possible that recreationists may have unknowingly vectored the pathogen via contaminated footwear or other equipment. It is also possible that high creek levels could have infected stream bank vegetation via *P. ramorum* inoculum from upstream Redwood Creek. Another plausible explanation is that long-distance spread has occurred via aerial movement of the pathogen's inocula, from areas upstream that are infested.

Significant spring rainfall over the last decade has supported increased pathogen activity in the area. Erroneous media reports have stated that California's drought is slowing the spread of the pathogen. Preliminary data from UC Berkeley suggests that sporulation on bay trees has increased both within and outside of currently infested, pure bay stands (Sims *et al.*, 2014, unpublished). Most evidence suggests that warm spring rain events accompanied by heavy winds are more important in promoting pathogen spread than total annual rainfall—the general measure used to determine “drought”.

RNP and UC Cooperative Extension have collaborated in sudden oak death detection efforts since 2005. In 2010 stream monitoring activities detected the presence of the pathogen in the stream water of Redwood Creek at a sampling location near to Orick. At that time the source of the inoculum appeared to be coming from Redwood Valley south of the confluence of Redwood Creek and Lack's Creek. Since 2010 increased stream monitoring efforts and enhanced aerial and ground detection measures have been employed to provide an early detection program for the Park.

Impacts of surface water diversions for marijuana cultivation on aquatic habitat in four northwestern California watersheds

By Scott Bauer, California Department of Fish and Wildlife (DFW); Adam Cockrill, DFW; Jennifer Olson, DFW; Michael van Hatten, DFW; Linda Miller, DFW; Gordon Leppig, DFW; and Margaret Tauzer, National Marine Fisheries Service

Large-scale marijuana cultivation has proliferated in northwestern California since the mid-1990s. The environmental impacts of marijuana cultivation appear substantial, yet have been difficult to quantify because cultivation is clandestine. We interpreted high-resolution aerial imagery to estimate the number of marijuana cultivation sites, greenhouses, and plants in four watersheds in northwestern California, USA. Low-elevation fixed-wing aircraft flights and cultivation site visits in the region validated assumptions used in aerial imagery interpretation. We estimated the water demand of marijuana irrigation and the potential effect water diversions could have on streamflow patterns. According to our estimates, water demands from marijuana cultivation have the potential to divert substantial proportions of the flow in our study watersheds, with our least impacted watershed seeing a maximum potential flow reduction of almost 60 percent, and other streams predicted to dry up entirely under certain diversion scenarios. These predictions are supported by field observations in our study watersheds documenting diminished or nonexistent flows during the summers in recent years. Diminished stream flow due to marijuana cultivation is highly likely to have lethal or sub-lethal effects on state and federally-listed fishes and further decline of sensitive amphibian species.

Climate, fire and forests in the 21st century at Redwood Creek

By Phillip J. van Mantgem, Research Ecologist, U.S. Geological Survey, Western Ecological Research Center

Recent studies have documented rapid increases in background forest mortality rates and greater incidence of large-scale (catastrophic) forest die-back, patterns logically associated with drought. Simultaneously, fire activity across much of western North America is increasing in size, frequency and severity. Learn about what this might mean for forest resources at Redwood Creek in the coming century.

For more information, see the published article: Phillip J. van Mantgem, et al. 2009. Widespread Increase of Tree Mortality Rates in the Western United States. *Science* 323, 521. <<http://www.sciencemag.org/cgi/content/full/323/5913/521>>.

Analysis of Recent California Droughts using the USGS Basin Characterization Model

By Jenny Curtis, California Water Science Center, USGS, Eureka, California; Lorrie Flint, Alan Flint and Michelle Stern, California Water Science Center, USGS, Sacramento, California

Drought impacts are cumulative and, consequently, drought severity is highly dependent on antecedent conditions. Although drought indices are typically used to define short-term deficits (<2 yrs) related to climate variability, management of natural resources requires a longer-term perspective (>2 yrs) that addresses cumulative effects. We characterized the relative severity of California's recent drought by using the USGS Basin Characterization Model (BCM). The BCM is a

monthly water-balance model that provides a statewide perspective of California's climate, soil moisture, and water supply conditions over the last century (1896 to 2014). Mean annual anomalies, calculated from simulated estimates of monthly water-balance parameters, were used to assess the magnitude, frequency, duration, and spatial extent of historic droughts across California. From the short-term perspective, the recent drought (2013-14) was wetter than the 1976-77 and 1991-92 droughts. From a longer-term perspective the 2007-14 drought was drier than the 1970-77 period and wetter than the 1985-92 period. Comparison of two 30-yr periods (1955-1984 and 1985-2014) indicates long-term desiccation has occurred across California, with the North Coast region experiencing some of the largest changes. For example, since 1984 there has been an 8% decline in mean-annual precipitation, a 10% decline in recharge, a 20% decline in runoff, and 30% decline in February snowpack within the Humboldt Bay/Mad River/Redwood Creek HUC-8 basin.

For more information, see <http://ca.water.usgs.gov/projects/reg_hydro/index.html>.

El Niño / Southern Oscillation (ENSO)

What does it mean for us and is El Nino still coming this fall?

By Matthew Kidwell, Lead Forecaster & Climate Program Team Leader, National Weather Service, Eureka

A brief look at the El Nino/Southern Oscillation (ENSO) as they relate to the precipitation for northwest California, specifically the Redwood Creek watershed. We will look at the temporal distribution and the probabilities of above and below normal rainfall as they relate to ENSO. In addition to this, we will look at the ongoing drought, where we stand in relation to historical time periods, and the prospect for improvement this winter.

For more information, see the Climate Prediction Center El Nino Page at <<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml>> and the National Oceanic and Atmospheric Administration Climate.gov ENSO Blog at <<http://www.climate.gov/news-features/department/8443/all>>.

Principles and practice of vulnerability assessment (VA)

By Michael J. Furniss, U.S. Forest Service, Redwood Sciences Lab (retired); MJ Furniss & Associates

The terminology of climate change vulnerability assessment (aka: risk or impact assessment) will be described, with recommendations. The IPCC model for analysis, as modified by the U.S. Forest Service, will be described. Several examples, focused on water resources and aquatic systems, conducted on several national forests and for the southern provinces of Ecuador will be introduced, with an emphasis on the climatic exposure component of the problem.

The concept of 'climatic refuge' will be introduced briefly in the context of the Rain Coast and our watersheds.

For more information, see <http://www.fs.fed.us/pnw/pubs/pnw_gtr884.pdf>.

Discussion of Redwood Creek Watershed Needs

At the end of the symposium, a discussion was convened in which symposium attendees were asked for input to identify needs for the Redwood Creek watershed. Below is a summary:

- Better integration of water, channel, forest, and aquatic species studies, possibly through a centralized database
- Evapotranspirative stress studies on the scale of forest, stand, and watershed
- Synthesis of fisheries data
- Greater collaboration with local tribes
- Accelerate actions for species recovery and climate change resiliency
- Advocate for more stable funding for long-term monitoring and solutions
- Research ways to stop or reduce fragmentation of forest habitats and subdivision of rural/forest lands
- Increase communication between agencies, scientists, and public
- More citizen involvement; communication with the general public (i.e. more community group talks, FAQ sheets, PSAs, K-12 and college presentations); make scientific presentations accessible and geared towards the general public
- Research whether prolonged estuary residence leads to better life history outcomes for salmonids
- Model multidimensional sediment routing for lower Redwood Creek
- Research relationship of forest/silviculture treatments to surface water and yield
- Research water rights and authorized diversions in the watershed, and analyze the impact of legal diversions and what they are likely doing to flows and fish. Figure out the effect on flows and fish of all of the diversions, authorized and unauthorized, that is, greatly expand on what DFW has been doing. More promotion of legal and environmentally friendly water conservation measures, such as water storage developed in wet season and used during dry season.
- Research levels of pesticides and other toxins in Redwood Creek & tributaries
- Research contribution of fog to the forest and water budget
- More education of younger people, next generation
- Investigate carbon sequestration & carbon cap-and-trade - could Redwood Creek watershed be a carbon sink, and could this fund the preservation of its forests?

List of Attendees

Redwood Creek Symposium

December 10, 2014, 9:15 am - 4:15 pm

Redwood National Park South Operations Center, Conference Room

121200 Highway 101, Orick, California

Sign-in Sheet

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